

POISONOUS PLANTS OF UTAH

Jack D. Brotherson, Lee A. Szyska, and William E. Evenson

ABSTRACT.— A list of the major livestock-poisoning plants has been compiled for the state of Utah. Two hundred fifteen taxa representing 36 families, 119 genera, and 209 species occur within the state. Forty-one percent are from two families, the Asteraceae and the Fabaceae. The remaining families of major importance are: Poaceae, Ranunculaceae, Solanaceae, Chenopodiaceae, Brassicaceae, Asclepiadaceae, Liliaceae, and Euphorbiaceae. Sixty-nine percent of the genera occur with a single species. Thirty-three percent of the taxa are introduced to the state. Most of the plants are insect pollinated; 57 percent are herbaceous perennials.

Most livestock poisoning occurs during the spring. This is due both to concentration of toxins in emerging vegetation and to the absence of more suitable forage on late winter and spring ranges. Green herbage is poisoning in about 80 percent of all taxa, seeds and fruits in about 15 percent, and the remaining 5 percent have toxic compounds confined to flower heads, sap, tubers, or roots. Disturbed or cultivated habitats and poorly managed range harbor the greatest diversity of poisonous plants. Wetlands contain fewer poisonous taxa than do xeric or mesic areas.

The predominating plant toxins are various alkaloids and glycosides. Sixteen percent of the plants have uncharacterized toxins. Cattle and sheep are more susceptible to poisoning than are horses, swine, or poultry.

Records document man's encounters with poisonous plants since ancient times. They have played both positive and negative roles in human culture (Dayton 1948). This conspicuous duality of poisonous plants remains a major concern for range management. Kingsbury's (1964) manual on the poisonous plants of the United States and Canada was designed to aid veterinarians and ranchers in recognizing poisonous plants and the symptoms they produce in poisoned livestock. Valentine (1978) prepared an extensive bibliography on the poisonous plants of American rangelands, and numerous works have been published dealing with local species lists and descriptions (Evers 1972, Mihalopoulos 1974, Schmutz et al. 1968, Stoddard et al. 1949, USDA 1968).

The scope of this paper is twofold: to provide a list of taxa of the major poisonous plants of Utah, and to present some general patterns observed among poisonous plants within the state. It is hoped that this annotated compilation and discussion will prove useful to range managers and biologists alike.

MATERIALS AND METHODS

Data on poisonous taxa were gleaned from the published literature and by consultation

with specialists in botany and toxicology. Much of the descriptive literature on poisonous plants is redundant, consequently, only the more recent works are cited here.

Criteria used in compiling the list of poisonous plants were:

1. The taxon had to be sufficiently abundant (either native or introduced) in natural ecosystems to constitute a legitimate threat to livestock or wildlife. For example, some species of the genus *Astragalus* are known to be toxic but are not abundant enough within the state to be considered dangerous (Williams and Barneby 1977).
2. Ornamentals were included only if they have escaped widely from cultivation. Such plants are frequent along ecotones or in disturbed habitats.
3. Suspicions of toxicity had to be reasonably well-founded. The genus *Astragalus*, for example, is represented by more than 100 species in Utah (Welsh 1975), but only those taxa demonstrably toxic were included in the present listing.

Additional variables considered for each taxon were: life history strategy (annual, biennial, perennial), patchiness of distribu-

¹Department of Botany and Range Science, Brigham Young University, Provo, Utah 84602.

²Department of Physics and Astronomy, Brigham Young University, Provo, Utah 84602.

tion, occurrence as a cultivar or as a common range plant, growth form (vine, forb, grass, shrub, or tree), generalized habitat requirements including elevation, soil texture and acidity, and moisture preference, nature of the toxin and its localization within the plant, seasonality of poisoning, animals affected, specific juvenile mortality and abortifacient properties. Not all variables could be documented for each species.

RESULTS

Taxonomy

Conservatively estimated, Utah has at least 215 major toxic taxa of plants representing 36 families, 119 genera, and 209 species. Thirty-three percent of these taxa are introduced to the state. Two of these 36 families, the Asteraceae and the Fabaceae contain 41 percent of the total known taxa of poisonous plants (Table 1). In decreasing order of floral prominence, the eight next important families are: Poaceae, Ranunculaceae, Solanaceae, Chenopodiaceae, Brassicaceae, Asclepiadaceae, Liliaceae, and Euphorbiaceae. The number of toxic taxa within a family is not related to the degree of toxicity of individual taxa: two of the most deadly plants, rosary pea or precatory bean (*Abrus precatorious*) and poison hemlock (*Conium maculatum*) belong to the Fabaceae and Apiaceae, one major and one relatively minor family if numbers alone are considered.

TABLE 1. Poisonous plant taxa by families.

Family	No. taxa	Percent of taxa occurring in each family
Fabaceae	50	23
Asteraceae	39	18
Poaceae	19	9
Ranunculaceae	13	6
Solanaceae	11	5
Chenopodiaceae	9	4
Brassicaceae	8	4
Asclepiadaceae	7	3
Liliaceae	7	3
Euphorbiaceae	6	3
26 other families	46	21
Total	215	

Sixteen genera (13 percent) occur in the flora with more than two taxa. Twenty-two other genera (18 percent) occur with two taxa (including *Cannabis*, which has two subspecies of a single species). Sixty-nine percent of the genera occur with a single species.

The taxonomy of poisonous plants is not readily explained. The poisonous flora of the eastern half of the United States resembles that of Europe more than it does that of the western states (Kingsbury 1961), and Dayton's paper (1948) on the poisonous plants of the continental United States gives a different listing of major families than that found for the state of Utah alone.

TABLE 2. Major toxins found in Utah's poisonous plant flora.

Toxin	Percent of taxa in which toxin occurs
Alkaloids	22
Glycosides	22
cyanogenetic glycosides	
goitrogenic glycosides	
irritant oils	
coumarin	
steroids and triterpenoids	
Selenium	11
Nitrates	5
Unknown toxins	16
Other toxins	19
amines	
oxalates	
resins and resinoids	
photosensitizing compounds	
nutritional deficiencies	
Mechanically injurious	4

Plant Toxins

Most poisonous principles are secondary by-products of the plants' metabolism (Kingsbury 1964, Levin 1976). In Utah's flora, many of these toxic metabolites are loosely classed as alkaloids and glycosides (Table 2). These two biochemical groups are primarily artificial constructs, and each consists of numerous toxins (only a few of which have been identified) having generally similar molecular structures or modes of activity.

When the impact of poisonous range plants on livestock mortality is assessed, however, many of the minor toxins become of

serious concern to ranchers. Selenium poisoning by members of the genus *Astragalus* and other species is an important source of mortality, as is oxalate poisoning by halogeton (*Halogeton glomeratus*) and fivehook bassia (*Bassia hyssopifolia*), and loss of sheep due to photosensitization by plants such as spring parsley (*Cymopterus watsonii*) and St. Johnswort (*Hypericum formosum*). Thus, the commonness of a particular plant species or toxin does not necessarily imply high mortality.

Seasonality and Specificity

Most livestock losses occur in the early spring (Table 3) as animals are turned out into slowly greening range (Evers 1972, Keefer 1978, Kingsbury 1964, Kreger and Sharp 1978, Merrill and Schuster 1978). A second, smaller peak in mortality follows in the summer as the more palatable vegetation withers in the heat and toxins are concentrated in fruits and seeds of poisonous species.

Cattle are susceptible to poisoning by more taxa than sheep, with consequently higher mortality rates and greater economic loss (Nielson 1978). Most of the toxic taxa commonly found on Utah's rangeland will poison all livestock but others are relatively species specific (such as *Delphinium* poisoning in cattle—ranges infected with the various species of this plant may be safely grazed by sheep). Other poisonous taxa may be grazed in moderate amounts without harm if alternative palatable forage is available, and some species, for example, halogeton, can be utilized by sheep if the animals are introduced gradually to the plant, allowing their rumen microflora to adapt to detoxifying large amounts of calcium oxalate (James et al. 1976).

The Ecology of Poisonous Plants

The ecology of Utah's poisonous flora is highly variable, but our data permit a few general observations. Most of the plants are insect pollinated, and 57% are herbaceous perennials. Green herbage is toxic in about 80% of all taxa, seeds and fruits in about 15%, and about 5% of the taxa have toxins confined to flower head, sap, tubers and roots. The relative locations and concentrations of toxins within a plant may vary through the growing season, and depend upon the particular taxon being considered.

Toxic species are likely to be found anywhere in the state, although disturbed habitats and poorly managed rangelands are especially prone to harbor dangerous species. The predominance of poisonous plants in these habitats reflects both a bias in the reported literature and the very real dangers of overgrazing in the western states. Dry desert soils have more taxa of poisonous plants than mesic or hydric ones; however, some of the individually most deadly plants occur in wetlands. Data on elevation, soil texture and acidity were insufficiently complete to permit any valid conclusions.

DISCUSSION AND SUMMARY

The benefit to the plant of manufacturing and maintaining toxic substances is unknown. A few phytotoxins such as abrin and cicutoxin appear to function specifically as vertebrate poisons (Kingsbury 1961, 1964) and may have evolved in response to herbivore pressures (Laycock 1978). Selenium accumulators are toxic due to characteristics of the soil, although primary accumulators may actually require trace amounts of selenium for proper growth (Kingsbury 1964).

There does not appear to be any universally applicable method for managing rangelands infested with poisonous plants. Species that occur in dense clumps or thickets may be individually irradiated by chemical or mechanical means. More commonly, however, vast areas will be infested, often as a result of overgrazing. Wise management will include aspects of the following practices:

1. Recognition of poisonous plants and an accurate assessment of their potential

TABLE 3. Livestock mortality by seasons.

Season	Percent of reported poisonings
Spring	65
Summer	17
Fall	11
Winter	6

Mortality especially high in the late winter and early spring

lethality. Unless forced by hunger, livestock generally will ignore poisonous plants in favor of more palatable forage.

2. Removal of susceptible animals.
3. Provision of sufficient alternate forage if animals must be turned onto ranges in early spring before palatable plants are abundant.
4. Scheduling of range use around livestock susceptibility patterns.

There are several good reviews of management practices (Evers 1972, Keeler 1978, Krueger and Sharp 1978, Merrill and Schuster 1978), and the range literature abounds in articles dealing with specific plants and their effects (see Valentine 1978 for a comprehensive listing). The purpose of the present paper is not to review management techniques in detail, but primarily to provide an updated listing of Utah's dangerous flora. Further research needs to be done not only in management but in toxicology and pharmacology so that control of poisonous plants will be a matter of understanding instead of eradication and vast areas of range can again be utilized and productive.

POISONOUS PLANTS OF UTAH

The present list of plant taxa was gleaned from published literature and by consultation with experts in botany and toxicology as cited above.

Certain plant characteristics are designated for each taxon in parentheses immediately following the taxon name. The abbreviations are as follows:

P	Perennial
B	Biennial
A	Annual
N	Native
I	Introduced
T	Tree
S	Shrub
F	Forb
G	Grass
R	Rush

The following list of families, genera, species, and varieties is arranged in alphabetical order for ease of reference. Plant synonymy follows *Manual of the Plants of Colorado* (Harrington 1964) and *Utah Plants* (Welsh and Moore 1973).

AMARANTHACEAE

Amaranthus retroflexus L. (AIF)

Common name: pigweed, carelessweed, redroot, redroot amaranth.

Toxin: nitrates, under conditions of over-fertilization with too little water.

Habitat: common garden and field weed; waste places.

Animals affected: livestock.

Reference: Brakenridge 1956, Kingsbury 1964.

ANACARDIACEAE

Toxicodendron rydbergii (Small) Greene (PNS)

Common name: poison ivy.

Toxin: 3-n-pentadecylcatechol.

Habitat: moist areas at lower elevations.

Animals affected: humans (dermatitis).

Reference: McNair 1923, Kingsbury 1964.

APIACEAE

Cicuta douglasii (DC.) Coult. & Rose (PNF)

Common name: Douglas waterhemlock.

Toxin: alcohol (cicutoxin).

Habitat: swampy or wet habitats along streams and in marshes.

Animals affected: livestock, humans.

Reference: Alberts 1931, Kingsbury 1964.

Conium maculatum L. (BIF)

Common name: hemlock, poisonous hemlock, spotted hemlock, California or Nebraska fern.

Toxin: alkaloids (conine, N-methyl conine, conhydrine, lambda-coniceine, pseudoconhydrine).

Habitat: weed of roadsides, ditches, edges of cultivated fields and other waste areas.

Animals affected: livestock, humans.

Reference: Penny 1953, Kingsbury 1964.

Daucus carota L. (BIF)

Common name: wild carrot, Queen Ann's lace.

Toxin: nitrates, under conditions of over-fertilization with too little water.

Habitat: waste places.

Animals affected: horses, cattle.

Reference: Volker 1950, Kingsbury 1964.

Pastinaca sativa L. var. *sylvestris* DC. (BIF)

Common name: common parsnip.

Toxin: unknown.

Habitat: widely naturalized weed.

Animals affected: humans (dermatitis).

Reference: S. L. Welsh (personal communication, 1980).

***Siim suave* Walt. (PNF)**

Common name: water parsnip, hemlock water parsnip.

Toxin: unknown.

Habitat: marshy lands and wet soils.

Animals affected: hogs, cattle.

Reference: Fyles 1920, Kingsbury 1964.

APOCYNACEAE

***Apocynum androsaemifolium* L. (PNF)**

Common name: spreading dogbane.

Toxin: resins, glycosides.

Habitat: common weed of open places, in coarse soils along streams, meadows, and wooded hillsides.

Animals affected: cats, dogs.

Reference: Moore 1909, Kingsbury 1964.

Note: The closely related species *A. me-dium* Greene and *A. sibericum* Jacq. may show similar effects.

***Apocynum cannabinum* L. (PNF)**

Common name: Indian hemp, dogbane, hemp dogbane.

Toxin: resins, glycosides.

Habitat: common weed of open places, in coarse soils along streams.

Animals affected: cats, dogs.

Reference: Finnemore 1909, Kingsbury 1964.

***Nerium oleander* L. (PIS)**

Common name: oleander.

Toxin: glycosides.

Habitat: cultivated greenhouse plant, street plant in St. George.

Animals affected: livestock, humans.

Reference: West 1957, Kingsbury 1964.

ASCLEPIADACEAE

***Asclepias asperula* (Decne) Woodson (PNF)**

Common name: asper milkweed, spider antelopehorn.

Toxin: resinoids, glycosides and an alkaloid.

Habitat: open dry soils, flats, desert swales, sandy or rocky hillsides with pinyon, juniper or oak.

Animals affected: sheep, cattle, goats, horses, poultry.

Reference: Huffman 1956, Kingsbury 1964.

***Asclepias fascicularis* Decne ex DC. (PNF)**

Common name: Mexican whorled milkweed.

Toxin: resinoids, glycosides and an alkaloid.

Habitat: dry hillsides and roadsides; pastures, moist streamsides.

Animals affected: sheep, cattle, goats, horses, fowl.

Reference: Schmutz et al. 1968.

***Asclepias incarnata* L. (PNF)**

Common name: swamp milkweed.

Toxin: resinoids, glycosides and an alkaloid.

Habitat: marshes.

Animals affected: sheep, cattle, horses, poultry.

Reference: Hansen 1924, Kingsbury 1964.

***Asclepias labriformis* Jones (PNF)**

Common name: labriform milkweed.

Toxin: resinoids, glycosides and an alkaloid.

Habitat: in sandy soils along old stream beds.

Animals affected: sheep.

Reference: Holmgren 1945, Kingsbury 1964.

***Asclepias latifolia* (Torr.) Raf. (PNF)**

Common name: broadleaf milkweed.

Toxin: resinoids, glycosides and an alkaloid.

Habitat: dry plains in sandy soils.

Animals affected: sheep.

Reference: Schmutz et al. 1968, Kingsbury 1964, Shrift 1958.

***Asclepias speciosa* Torr. (PNF)**

Common name: showy milkweed.

Toxin: resinoids, glycosides, and an alkaloid.

Habitat: prairies and open areas.

Animals affected: sheep.

Reference: Fleming 1920, Kingsbury 1964.

***Asclepias subverticillata* (Gray) Vail (PNF)**

Common name: whorled milkweed, western whorled milkweed.

Toxin: resinoids, glycosides and an alkaloid.

Habitat: dry plains and foothills; spreads rapidly along waterways and irrigation canals, forming dense stands; prefers sandy soils.

Animals affected: sheep.

Reference: Glover 1917, Kingsbury 1964.

ASTERACEAE

Achillea millefolium L. (PNF)

Common name: yarrow.

Toxin: alkaloids and glycosides.

Habitat: various.

Animals affected: livestock.

Reference: Hurst 1942, Kingsbury 1964.

Ambrosia tomentosa Nutt. (PNF)

Common name: white ragweed, skeleton leaf bursage

Toxin: nitrates, under conditions of over-fertilization with too little water.

Habitat: dry plains, hills, waste ground and fields.

Animals affected: livestock.

Reference: Huffman 1956, Kingsbury 1964.

Anthemis cotula L. (AIF)

Common name: dog fennel, mayweed, mayweed camomile.

Toxin: acrid substance irritating to mucous membranes.

Habitat: weedy plant of disturbed soils, fields and waste places; common weed in hay.

Animals affected: poultry.

Reference: Los Angeles County Livestock Department 1938, Kingsbury 1964.

Artemisia filifolia Torr. (PNS)

Common name: sand sagebrush, old man sagebrush.

Toxin: volatile oils.

Habitat: sandy soils.

Animals affected: horses.

Reference: Beath 1953, Kingsbury 1964.

Artemisia spinescens (DC.) Eaton (PNS)

Common name: bud sagebrush.

Toxin: volatile oils.

Habitat: dry plains and hills.

Animals affected: livestock.

Reference: Sampson 1942, Kingsbury 1964.

Aster chilensis Nees ssp. *adscendens* (Lindl.)

Cronq. (PNF)

Common name: pacific aster.

Toxin: secondary selenium accumulator.

Habitat: widely scattered in moist habitats. Animals affected: livestock.

Reference: Trelease and Beath 1949, Kingsbury 1964.

Aster glaucodes Blake (PNF)

Common name: gray aster.

Toxin: secondary selenium accumulator.

Habitat: mountains.

Animals affected: sheep.

Reference: Trelease and Beath 1949, Kingsbury 1964.

Aster laevis L. (PNF)

Common name: smooth aster.

Toxin: secondary selenium accumulator.

Habitat: widely scattered in dry to moist habitats.

Animals affected: livestock.

Reference: Trelease and Beath 1949, Kingsbury 1964.

Aster occidentalis (Nutt.) Torr. & Gray (PNF)

Common name: western aster.

Toxin: secondary selenium accumulator.

Habitat: mountain meadows at moderate elevations.

Animals affected: livestock.

Reference: Trelease and Beath 1949, Kingsbury 1964.

Aster pauciflorus Nutt. (PNF)

Common name: fewhead aster.

Toxin: secondary selenium accumulator.

Habitat: widespread in saline soils.

Animals affected: livestock.

Reference: J. D. Brotherson (personal communication, 1980).

Bahia oppositifolia (Nutt.) DC. (PNF)

Common name: bahia, plains bahia.

Toxin: cyanogenetic glycoside.

Habitat: dry soils; plains and hills.

Animals affected: cattle, sheep.

Reference: Deem et al. 1939, Kingsbury 1964.

Baileya multiradiata Harv. & Gray (BNF)

Common name: desert baileya, cloth of gold, desert marigold.

Toxin: unknown.

Habitat: sandy and gravelly soils in dry areas.

Animals affected: sheep, goats.

Reference: Mathews 1933, Kingsbury 1964.

***Baileya pleniradiata* Harv. & Gray (ANF)**

Common name: desert marigold baileya.

Toxin: unknown.

Habitat: mesas and deserts of southeastern Utah.

Animals affected: sheep, goats.

Reference: Schmutz et al. 1968.

***Centaurea repens* L. (PIF)**

Common name: Russian knapweed.

Toxin: unknown; produces nigropallidal encephalomalacia.

Habitat: fields, roadsides and waste places.

Animals affected: horses.

Reference: Mecke 1979.

***Centaurea solstitialis* L. (AIF)**

Common name: yellow star thistle, yellow centaurea.

Toxin: unknown; produces nigropallidal encephalomalacia; also mechanically injurious.

Habitat: waste places, fields and roadsides.

Animals affected: horses.

Reference: Mettler and Stern 1963, Kingsbury 1964.

***Chrysothamnus nauseosus* (Pall.) Britton (PNS)**

Common name: rubber rabbitbrush.

Toxin: unknown.

Habitat: dry, open places at moderate and low elevations.

Animals affected: livestock.

Reference: Sampson 1942, Kingsbury 1964.

***Grindelia squarrosa* (Pursh) Dunal (BNF)**

Common name: gumweed, gumplane, curlycup gumweed.

Toxin: secondary selenium accumulator.

Habitat: dry open places; prairies, plains, roadsides and fields.

Animals affected: livestock.

Reference: Trelease and DiSomma 1960, Kingsbury 1964.

***Helenium autumnale* L. (PNF)**

Common name: sneezeweed, bitterweed.

Toxin: unknown acrid substance.

Habitat: moist low ground in lowlands and foothills.

Animals affected: sheep and cattle.

Reference: Kingsbury 1964.

***Helenium hoopesii* Gray (PNF)**

Common name: sneezeweed, orange sneezeweed.

Toxin: glycoside (dugaldine).

Habitat: high mountain slopes and valleys, often forming dense stands in moist, sunny, undisturbed localities.

Animals affected: sheep and cattle.

Reference: Marsh et al. 1921, Kingsbury 1964.

***Heleomeris longifolia* Rob. & Greenm. var. *annua* (Jones) Yates (ANF)**

Common name: annual goldeneye, resinweed, tallweed.

Toxin: unknown.

Habitat: ranges, hills, plains, and river bottoms.

Animals affected: cattle.

Reference: Schmutz et al. 1968, Kingsbury 1964.

***Hymenoxys richardsonii* (Hook.) Cockerell (PNF)**

Common name: pingue. Colorado rubberweed, pingue hymenoxys, rubberweed.

Toxin: unknown; may be associated with mineral imbalance.

Habitat: dry, rocky or clay soils of plains and mountain slopes from 1500 to 12,000 feet.

Animals affected: sheep, cattle, goats.

Reference: Aanes 1961, Kingsbury 1964.

***Oxytenia acerosa* Nutt. (PNS)**

Common name: copperweed; prickly oxytenia.

Toxin: unknown.

Habitat: alkaline soils in draws or streambeds of desert ranges and foothills.

Animals affected: cattle, sheep.

Reference: Throp et al. 1940, Kingsbury 1964.

***Psathyrotes annua* (Nutt.) Gray (ANF)**

Common name: annual psathyrotes.

Toxin: unknown.

Habitat: dry, sandy, often alkaline soils, especially of creek beds and dry washes.

Animals affected: sheep.

Reference: Binns et al. 1962, Kingsbury 1964.

***Psilostrophe sparsiflora* (Gray) A. Nels. (PNF)**

Common name: greenstem paperflower.

Toxin: unknown; induces kidney damage.

Habitat: dry, open range.

Animals affected: sheep.

Reference: Huffman 1956, Kingsbury 1964.

Rudbeckia occidentalis Nutt. (PNF)

Common name: western coneflower, nigerheads.

Toxin: unknown.

Habitat: streambanks and woodlands.

Animals affected: generally unpalatable to livestock; affects hogs and sheep in feeding trials.

Reference: Pammel 1911, Kingsbury 1964.

Senecio integerrimus Nutt. (PNF)

Common name: groundsel, senecio, lambs-tongue groundsel.

Toxin: alkaloids.

Habitat: dry or moist open woods and slopes, from valleys to near timberline.

Animals affected: livestock, humans (?).

Reference: Clawson 1933, Kingsbury 1964.

Senecio longilobus Benth. (PNF)

Common name: woolly groundsel, thread-leaf groundsel.

Toxin: pyrrolizidine alkaloids.

Habitat: dry slopes, mesas and dry washes.

Animals affected: cattle, horses, sheep, goats.

Reference: Clawson 1933, Kingsbury 1964.

Senecio spartioides Torr. & Gray (PNF)

Common name: broom groundsel.

Toxin: pyrrolizidine alkaloids.

Habitat: valleys, plains: open areas and pine forests.

Animals affected: cattle, horses, sheep, goats, humans(?).

Reference: Clawson 1933, Kingsbury 1964, Davis 1958.

Senecio vulgaris L. (AIF)

Common name: common groundsel.

Toxin: pyrrolizidine alkaloids.

Habitat: weed of gardens and waste places.

Animals affected: cattle, horses, sheep, goats, humans(?).

Reference: Steyn 1934, Kingsbury 1964.

Solidago parryi (Gray) Greene (PNF)

Common name: Parry goldenweed.

Toxin: unknown: causes milk-sickness or trembles.

Habitat: mountains, coniferous forests.

Animals affected: cattle.

Reference: Schmutz et al. 1968, Kingsbury 1964.

Tanacetum vulgare L. (PIF)

Common name: common tansy.

Toxin: abortifacient.

Habitat: weed along roadsides, waste areas, ditchbanks and other moist areas.

Animals affected: cattle, humans(?).

Reference: Gress 1935, Kingsbury 1964.

Tetradymia canescens DC. (PNS)

Common name: spineless horsebrush, gray horsebrush.

Toxin: photosensitizing compounds.

Habitat: dry desert and sagebrush ranges.

Animals affected: sheep.

Reference: Kingsbury 1964, Schmutz et al. 1968.

Tetradymia glabrata Gray (PNS)

Common name: littleleaf horsebrush, spring rabbitbrush, coaloil brush.

Toxin: photosensitizing compounds.

Habitat: dry desert and sagebrush ranges.

Animals affected: sheep.

Reference: Kingsbury 1964, Fleming et al. 1922.

Tetradymia nuttallii T. & G. (PNS)

Common name: Nuttall horsebrush.

Toxin: photosensitizing compounds.

Habitat: dry desert and sagebrush ranges.

Animals affected: sheep.

Reference: Kingsbury 1964.

Tetradymia spinosa T. and G. var. *longispina* Jones (PNS)

Common name: longspine horsebrush.

Toxin: photosensitizing compounds.

Habitat: dry desert and sagebrush ranges.

Animals affected: sheep.

Reference: S. L. Welsh (personal communication, 1980).

Tetradymia spinosa T. and G. var. *spinosa* (PNS)

Common name: spiny horsebrush.

Toxin: photosensitizing compounds.

Habitat: dry desert and sagebrush ranges.

Animals affected: sheep.

Reference: S. L. Welsh (personal communication, 1980).

Xanthium strumarium L. (AIF)

Common name: spiny clotbur, spiny cocklebur.

Toxin: hydroquinone.

Habitat: fields and wastelands; along shores of ponds, rivers and in flood plains.

Animals affected: livestock, fowl, hogs, humans (dermatitis).

Reference: Forrest 1938, Kuzel and Miller 1950, Kingsbury 1964.

Xanthocephalum microcephalum (DC.) Gray (PNS)

Common name: broomweed, perennial snakeweed, slinkweed, turpentine weed, threadleaf snakeweed, matchweed, resinweed.

Toxin: saponin.

Habitat: dry stony plains, slopes and mesas.

Animals affected: cattle, sheep, goats, swine, chicks, rabbits.

Reference: Dollahite 1957, Kingsbury 1964.

Xanthocephalum sarothrae (Pursh) Britt. and Rusby (ANF)

Common name: broom snakeweed, snakeweed, matchbrush.

Toxin: saponin.

Habitat: dry stony plains, slopes and mesas.

Animals affected: cattle, sheep, goats, swine, chicks, rabbits.

Reference: Dollahite 1962, Kingsbury 1964.

BORAGINACEAE

Amsinckia intermedia Fisch. & Mey (ANF)

Common name: tarweed, fiddleneck, fireweed fiddleneck.

Toxin: unknown; potentially lethal nitrate levels, pyrrolizidine alkaloids (?).

Habitat: dry open cultivated ground or waste areas.

Animals affected: horses, hogs, cattle.

Reference: McCulloch 1940, Kingsbury 1964.

Note: The closely related species *A. tessellata* Gray and *A. retrorsa* Suksd. may show similar effects.

Cynoglossum officinale L. (BIF)

Common name: houndstongue.

Toxin: unknown.

Habitat: waste places of plains and hills.

Animals affected: livestock.

Reference: Kingsbury 1964, S. L. Welsh (personal communication, 1980).

BRASSICACEAE

Brassica hirta Moench. (AIF)

Common name: white mustard.

Toxin: cyanogenetic glycoside.

Habitat: cultivated weed, escaped to waste areas.

Animals affected: cattle, sheep.

Reference: Eaton 1941, Kingsbury 1964.

Brassica kaber Wheeler (AIF)

Common name: charlock, wild mustard.

Toxin: cyanogenetic glycoside.

Habitat: common weed of grain crops and in waste areas.

Animals affected: cattle, hogs, sheep.

Reference: Thomson and Sifton 1922, Kingsbury 1964.

Descurainia pinnata (Walt.) Britt. (ANF)

Common name: tansy mustard, pinnate tansy mustard.

Toxin: unknown.

Habitat: heavy stands on dry, sandy soils.

Animals affected: cattle.

Reference: Hershey 1935, Kingsbury 1964.

Erysimum cheiranthoides L. (ANF)

Common name: wormweed mustard, treacle wallflower.

Toxin: cyanogenetic glycoside.

Habitat: weed of cultivation, roadsides, meadows; moist waste areas in valleys and canyons.

Animals affected: hogs.

Reference: Thomson and Sifton 1922, Kingsbury 1964.

Stanleya integrifolia James (PNS)

Common name: wholeleaf desert prince's plume.

Toxin: primary selenium accumulator.

Habitat: dry plains and hills.

Animals affected: Not observed to be eaten by livestock.

Reference: Beath et al. 1953, Kingsbury 1964.

Stanleya pinnata (Pursh) Britt. (PNS)

Common name: prince's plume, desert prince's plume.

Toxin: primary selenium accumulator.

Habitat: desert soils, dry plains and mesas.

Animals affected: experimental, normally unpalatable.

Reference: Beath et al. 1953, Kingsbury 1964.

Stanleya viridiflora Nutt. (PNF)

Common name: greenflower prince's plume.

Toxin: primary selenium accumulator.

Habitat: dry plains and hills.

Animals affected: Not observed to be eaten by livestock.

Reference: Beath et al. 1953, Kingsbury 1964.

Thlaspi arcense L. (AIF)

Common name: fanweed, field penny-cress.

Toxin: cyanogenetic glycoside.

Habitat: Common weed of cultivated and waste places.

Animals affected: livestock.

Reference: Thomson and Sifton 1922, Kingsbury 1964.

CANNABINACEAE

Cannabis sativa L. ssp. *sativa* (AIF)

Common name: marijuana, hemp.

Toxin: narcotic element contained in tetrahydrocannabinol.

Habitat: waste places.

Animals affected: humans, livestock.

Reference: Steyn 1934, Kingsbury 1964, Small and Cronquist 1976, Welsh 1980.

Cannabis sativa L. ssp. *indica* (Lam.) Small & Cronq. (AIF)

Common name: marijuana, hemp.

Toxin: narcotic element contained in tetrahydrocannabinol.

Habitat: waste places.

Animals affected: humans, livestock.

Reference: Small and Cronquist 1976, Welsh 1980.

CAPRIFOLIACEAE

Sambucus coerulea Raf. (PNS)

Common name: blue elderberry.

Toxin: unknown.

Habitat: moist soils of plains and hills.

Animals affected: cattle, children (?)

Reference: Schmutz et al. 1968.

Sambucus racemosa L. (PNS)

Common name: red elder.

Toxin: unknown; concentrated in root.

Habitat: moist forests, 7,500-10,000 ft.

Animals affected: cattle, children(?)

Reference: Schmutz et al. 1968.

CARYOPHYLLACEAE

Saponaria officinalis L. (PIF)

Common name: bouncing bet, soapwort.

Toxin: saponin.

Habitat: fields, waste places; cultivated and escaping.

Animals affected: sheep.

Reference: Kingsbury 1964.

CHENOPODIACEAE

Atriplex gardneri Moq. (PNS)

Common name: Nuttall saltbush, Gardner saltbush.

Toxin: secondary selenium accumulator.

Habitat: saline plains and hillsides.

Animals affected: livestock.

Reference: Fleming 1920, Kingsbury 1964.

Bassia hyssopifolia (Pall.) Volk (AIF)

Common name: fivehook bassia, smotherweed.

Toxin: oxalates.

Habitat: dry, saline soils.

Animals affected: sheep.

Reference: Pammel 1911.

Chenopodium ambrosioides L. (AIF)

Common name: wormseed goosefoot.

Toxin: antihelminthic oil.

Habitat: weed of waste places.

Animals affected: geese, humans.

Reference: Bamford 1951, Kingsbury 1964.

Chenopodium album L. (AIF)

Common name: lambsquarter.

Toxin: nitrates, under conditions of over-fertilization with too little water.

Habitat: weed of waste places.

Animals affected: livestock.

Reference: Case 1957, Kingsbury 1964.

Chenopodium glaucum L. (AIF)

Common name: oakleaf goosefoot.

Toxin: nitrates, under conditions of over-fertilization with too little water.

Habitat: weed of waste places.

Animals affected: livestock.

Reference: Case 1957, Kingsbury 1964.

Halogeton glomeratus (Bieb.) C. A. Mey (AIF)

Common name: halogeton, barilla.

Toxin: oxalates.

Habitat: dry saline plains and alkaline soils; roadsides.

Animals affected: livestock, especially sheep.

Reference: Cook and Stoddart 1953, Kingsbury 1964.

***Kochia scoparia* L. Schrad. (AIF)**

Common name: summer cypress, burning bush, Mexican fireweed, Belvedere summer cypress.

Toxin: photosensitizing compounds.

Habitat: dry soils, roadsides and waste places.

Animals affected: cattle, sheep, horses.

Reference: Rottgardt 1944, Kingsbury 1964, Schmutz et al. 1968.

***Salsola iberica* Sennen & Pau (AIF)**

Common name: Russian thistle.

Toxin: nitrates (?), possible oxalates (?).

Habitat: dry soils of plains and foothills.

Animals affected: livestock.

Reference: Huffman et al. 1956.

***Sarcobatus vermiculatus* (Hook.) Torr. (PNS)**

Common name: greasewood, black greasewood.

Toxin: oxalates.

Habitat: dense stands confined to alkaline flats or saline soils of low and lower middle elevations.

Animals affected: sheep, sometimes cattle.

Reference: Kouch 1922, Kingsbury 1964.

CYPERACEAE

***Scirpus pungens* Vahl (PNR)**

Common name: bulrush, three-square, American bulrush.

Toxin: unknown; suspected of producing pulmonary emphysema.

Habitat: wet or moist ground.

Animals affected: cattle.

Reference: Beath et al. 1953, Kingsbury 1964.

EQUISETACEAE

***Equisetum arvense* L. (PNF)**

Common name: horsetail, foxtail, rush, marsh horsetail.

Toxin: alkaloids.

Habitat: sandy or gravelly soils along streams and in moist fields and meadows.

Animals affected: horses.

Reference: Gussow 1912, Kingsbury 1964.

***Equisetum laevigatum* A. Br. (PNF)**

Common name: smooth horsetail.

Toxin: thiaminase.

Habitat: marshes, alluvial thickets, sandy banks; weed of cultivation.

Animals affected: horses.

Reference: Sampson and Malmsten 1942, Kingsbury 1964.

ERICACEAE

***Kalmia microphylla* (Hook.) Heller (PNS)**

Common name: pale laurel, bog laurel, alpine kalmia.

Toxin: resinoids, andromedotoxin.

Habitat: wet meadows and bogs of high elevation.

Animals affected: sheep, calves, goats.

Reference: Kingsbury 1964.

***Ledum glandulosum* Nutt. (PNS)**

Common name: western Labrador tea.

Toxin: resinoids, andromedotoxin.

Habitat: wet meadows and bogs of high elevation.

Animals affected: sheep, cattle.

Reference: Kingsbury 1964.

EUPHORBIACEAE

***Croton longipes* Jones (PNF)**

Common name: croton.

Toxin: croton oil (caustic).

Habitat: roadsides, fields, and dry streambeds; artemisia and pinyon belts.

Animals affected: livestock.

Reference: Schmutz et al. 1968, S. L. Welsh (personal communication, 1980).

***Croton texensis* (Klotz.) Muell. Arg. ex DC. (ANF)**

Common name: Texas croton.

Toxin: croton oil (caustic).

Habitat: roadsides, fields, and dry streambeds; artemisia and pinyon belts.

Animals affected: livestock.

Reference: Volker 1950, Kingsbury 1964, Schmutz et al. 1968.

***Euphorbia cyparissias* L. (PIF)**

Common name: cypress spurge, graveyard weed.

Toxin: unknown acrid principle.

Habitat: cultivated and escaping to roadsides and waste places.

Animals affected: cattle.

Reference: Muenscher 1935, Kingsbury 1964.

Euphorbia esula L. (PIF)

Common name: leafy spurge.

Toxin: unknown acrid principle.

Habitat: field weed of roadsides and waste places.

Animals affected: horses, sheep.

Reference: Johnston and Peake 1960, Kingsbury 1964.

Reverchonnia arenaria Gray (ANF)

Common name: reverchonnia, sand reverchonnia.

Toxin: unknown.

Habitat: uncommon; plains and hillsides, sandy areas, Kane Co.

Animals affected: sheep.

Reference: Schmutz et al. 1968, Kingsbury 1964.

Ricinus communis L. (AIF)

Common name: castor bean.

Toxin: ricin (a phytotoxin).

Habitat: cultivated as an ornamental.

Animals affected: livestock, humans.

Reference: Clarke 1947, Kingsbury 1964.

FABACEAE

Acacia greggii Gray (PNT)

Common name: catclaw acacia.

Toxin: cyanogenetic glycoside.

Habitat: plains and dry canyons; forms thickets along Beaver Dam Wash, Washington Co.

Animals affected: sheep.

Reference: Schmutz et al. 1968, Kingsbury 1964.

Astragalus asclepiadoides Jones (PNF)

Common name: milkweed milkvetch.

Toxin: primary selenium accumulator.

Habitat: saline desert areas.

Animals affected: livestock.

Reference: Welsh 1978.

Astragalus bisulcatus (Hook.) Gray (PNF)

Common name: two-grooved poisonvetch, two-grooved milkvetch.

Toxin: primary selenium accumulator.

Habitat: plains and bottom lands, sagebrush zone.

Animals affected: livestock.

Reference: Welsh 1978, Kingsbury 1964.

Astragalus convallarius Greene var. *convallarius* (PNF)

Common name: timber poisonvetch, lesser rushy milkvetch.

Toxin: produces locoism.

Habitat: dry hillsides, desert shrub to lower montane zones.

Animals affected: livestock.

Reference: Muenscher 1951, Kingsbury 1964.

Astragalus drummondii Dougl. ex Hook. (PNF)

Common name: Drummond milkvetch.

Toxin: produces locoism.

Habitat: plains and hillsides, brushy places.

Animals affected: livestock.

Reference: Welsh 1978, Kingsbury 1964.

Astragalus eastwoodae Jones (PNF)

Common name: Eastwood poisonvetch, Eastwood milkvetch.

Toxin: primary selenium accumulator.

Habitat: dry hillsides.

Animals affected: livestock.

Reference: Welsh 1978, Kingsbury 1964.

Astragalus flavus Nutt. ex Torr. & Gray var. *argillosus* (Jones) Barneby (PNF)

Common name: yellow milkvetch.

Toxin: primary selenium accumulator.

Habitat: dry plains and hillsides, salt desert areas.

Animals affected: livestock.

Reference: Welsh 1978.

Astragalus flavus Nutt. ex Torr. & Gray var. *candicans* Gray (PNF)

Common name: Canada yellow milkvetch.

Toxin: primary selenium accumulator.

Habitat: dry plains and hillsides, shales and clays of southern Utah.

Animals affected: livestock.

Reference: Welsh 1978.

Astragalus flavus Nutt. ex Torr. & Gray var. *flavus* (PNF)

Common name: yellow milkvetch.

Toxin: primary selenium accumulator.

Habitat: dry plains and hillsides, saline silts and clays in saline desert areas, south-central Utah.

Animals affected: livestock.

Reference: Welsh 1978, Kingsbury 1964.

***Astragalus iselyi* Welsh (PNF)**

Common name: Isely milkvetch.
 Toxin: primary selenium accumulator.
 Habitat: dry hillsides, salt desert areas.
 Animals affected: livestock.
 Reference: Welsh 1978.

***Astragalus lentiginosus* Dougl. ex Hook. var. *araneosus* (Sheld.) Barneby (PNF)**

Common name: spider locoweed, cobweed milkvetch.
 Toxin: produces locoism.
 Habitat: dry hillsides in sagebrush.
 Animals affected: livestock.
 Reference: Welsh 1978, Kingsbury 1964.

***Astragalus lentiginosus* Dougl. ex Hook. var. *palans* (Jones) Jones (PNF)**

Common name: straggling milkvetch.
 Toxin: produces locoism.
 Habitat: salt desert areas, dry hillsides and canyons, mixed desert shrub communities.
 Animals affected: livestock.
 Reference: Welsh 1978, S. L. Welsh (personal communication, 1980), Kingsbury 1964.

***Astragalus lentiginosus* Dougl. ex Hook. var. *wahweapensis* Welsh (PNF)**

Common name: Wahweap loco, Wahweap milkvetch.
 Toxin: produces locoism.
 Habitat: dry hillsides in sagebrush, sandy soils, Kane Co.
 Animals affected: livestock, esp. horses.
 Reference: Welsh 1978, Kingsbury 1964.

***Astragalus miser* Dougl. ex Hook. var. *oblongifolius* (Rydb.) Cronq. (PNF)**

Common name: timber milkvetch, Rydberg weedy milkvetch.
 Toxin: miserotoxin.
 Habitat: widely scattered in lower montane zones.
 Animals affected: livestock.
 Reference: Williams 1969, Welsh 1978.

***Astragalus moencoppensis* Jones (PNF)**

Common name: Moenkopi poisonvetch, Moenkopi milkvetch.
 Toxin: primary selenium accumulator.
 Habitat: heavy soils, salt desert through pinyon-juniper areas.
 Animals affected: livestock.
 Reference: Welsh 1978, Kingsbury 1964.

***Astragalus mollissimus* Torr. (PNF)**

Common name: Thompson woolly loco-weed.
 Toxin: produces locoism.
 Habitat: dry plains and hillsides.
 Animals affected: livestock.
 Reference: Welsh 1978, Kingsbury 1964.

***Astragalus pattersonii* Gray ex Brand. (PNF)**

Common name: Patterson locoweed, Patterson milkvetch.
 Toxin: primary selenium accumulator.
 Habitat: dry plains and hillsides.
 Animals affected: livestock.
 Reference: Welsh 1978, Kingsbury 1964.

***Astragalus praelongus* Sheldon (PNF)**

Common name: stinking milkvetch.
 Toxin: primary selenium accumulator.
 Habitat: dry plains and hillsides, clay and seleniferous soils.
 Animals affected: livestock.
 Reference: Welsh 1978.

***Astragalus preussii* Gray (PNF)**

Common name: Preuss milkvetch.
 Toxin: primary selenium accumulator.
 Habitat: dry plains and hillsides, seleniferous clays and silts.
 Animals affected: livestock.
 Reference: Welsh 1978, Kingsbury 1964.

***Astragalus pubentissimus* Torr. & Gray (PNF)**

Common name: Green River locoweed, Green River milkvetch.
 Toxin: produces locoism.
 Habitat: canyons, mountainsides.
 Animals affected: livestock, mainly sheep.
 Reference: Buck 1961, Kingsbury 1964.

***Astragalus racemosus* Pursh var. *trelesi* Porter (PNF)**

Common name: alkali milkvetch.
 Toxin: primary selenium accumulator, causes "alkali disease" or "blind staggers."
 Habitat: Uinta and Duchesne River formations.
 Animals affected: cattle.
 Reference: Welsh 1978.

***Astragalus rafaelsensis* Jones (PNF)**

Common name: San Rafael milkvetch.
 Toxin: primary selenium accumulator.
 Habitat: seleniferous clays and silts, salt desert shrub zones, Emery Co.

- Animals affected: livestock.
Reference: Welsh 1978.
- Astragalus sabulosus* Jones (PNF)
Common name: straightstem poisonvetch,
Cisco milkvetch.
Toxin: primary selenium accumulator.
Habitat: salt desert shrub zone on shales.
Animals affected: livestock.
Reference: Welsh 1978, Marsh 1935.
- Astragalus saurinus* Barneby (PNF)
Common name: dinosaur milkvetch.
Toxin: primary selenium accumulator.
Habitat: salt desert shrub and pinyon-juniper zone, Uintah Co.
Animals affected: livestock.
Reference: Welsh 1978.
- Astragalus tetrapterus* Gray (PNF)
Common name: fourwing poisonvetch,
four-wing milkvetch.
Toxin: produces locoism.
Habitat: plains, dry hillsides.
Animals affected: cattle, sheep.
Reference: Marsh 1920, Welsh 1978.
- Astragalus toanus* Jones (PNF)
Common name: Toano milkvetch.
Toxin: primary selenium accumulator.
Habitat: clay soils, salt desert shrub zone.
Animals affected: livestock.
Reference: Welsh 1978, Kingsbury 1964.
- Astragalus woodruffii* Jones (PNF)
Common name: Woodruff milkvetch.
Toxin: primary selenium accumulator.
Habitat: desert shrub zone on sandy and sandy-silt soils.
Animals affected: livestock.
Reference: Welsh 1978.
- Lathyrus latifolius* L. (PIF)
Common name: perennial peavine, perennial sweet pea.
Toxin: alpha, gamma-diaminobutyric acid.
Habitat: rangeland.
Animals affected: rats (experimental), sheep (lathyrism).
Reference: Lewis 1949, Kingsbury 1964, S. L. Welsh (personal communication, 1980).
- Lathyrus sylvestris* L. (PNF)
Common name: everlasting sweetpea, flat pea.
Toxin: alpha, gamma-diaminobutyric acid.
- Habitat: rangeland.
Animals affected: sheep, rats (experimental).
Reference: Lewis 1948, Kingsbury 1964.
- Lupinus alpestris* A. Nels. (PNF)
Common name: mountain lupine.
Toxin: alkaloids.
Habitat: mountains.
Animals affected: cattle, sheep.
Reference: Beath et al. 1953, Kingsbury 1964.
- Lupinus arbustus* Dougl. ex Lindl. var. *calcaratus* (Kellogg) Welsh (PNF)
Common name: Douglas spurred lupine, spur lupine.
Toxin: alkaloids.
Habitat: hillsides, dry soils.
Animals affected: cattle, horses, sheep.
Reference: Clawson 1931, Kingsbury 1964.
- Lupinus argenteus* Pursh (PNF)
Common name: silvery lupine.
Toxin: alkaloids.
Habitat: dry flats and slopes in woods, plains and hills.
Animals affected: sheep, cattle, horses, goats, hogs, deer.
Reference: Marsh 1916, Kingsbury 1964.
- Lupinus caudatus* Kell. (PNF)
Common name: Kellogg's spurred lupine, tailcut lupine.
Toxin: alkaloids.
Habitat: exposed hillsides.
Animals affected: cattle.
Reference: Animal Disease and Parasite Research Division USDA 1958, Kingsbury 1964.
- Lupinus leucophyllus* Dougl. (PNF)
Common name: woolly-leaved lupine, velvet lupine.
Toxin: alkaloids.
Habitat: dry soil, foothills.
Animals affected: sheep, cattle, horses, goats, hogs, deer.
Reference: Marsh 1916, Kingsbury 1964.
- Lupinus pusillus* Pursh (ANF)
Common name: low lupine, rusty lupine.
Toxin: alkaloids.
Habitat: dry plains, foothills.
Animals affected: sheep.
Reference: Sampson 1942, Kingsbury 1964.

***Lupinus sericeus* Pursh (PNF)**

Common name: silky lupine.

Toxin: alkaloids.

Habitat: dry hillsides and valleys.

Animals affected: sheep, cattle, horses, goats, hogs, deer.

Reference: Binns and James 1961, Kingsbury 1964.

***Medicago sativa* L. (PIF)**

Common name: alfalfa, lucerne.

Toxin: saponin.

Habitat: cultivated and escaping.

Animals affected: cattle, chicks, hogs, sheep.

Reference: Walter 1954, Kingsbury 1964.

***Melilotus alba* Desr. (BIF)**

Common name: white sweetclover.

Toxin: dicoumarin.

Habitat: waste places and fields, escaped from cultivation.

Animals affected: cattle.

Reference: Roderick 1931, Kingsbury 1964.

***Melilotus officinalis* L. Lam. (BIF)**

Common name: yellow sweetclover.

Toxin: dicoumarin.

Habitat: waste ground, fields; used for forage and fertilizer.

Animals affected: cattle, sheep, horses.

Reference: Roderick 1931, Kingsbury 1964.

***Oxytropis lambertii* Pursh (PNF)**

Common name: white loco, white paint loco, silky crazyweed.

Toxin: unknown alkaloids; produces locoism.

Habitat: prairies and mountains, usually in drier areas, lower to middle elevations.

Animals affected: livestock.

Reference: Couch 1929, Kingsbury 1964.

***Oxytropis sericea* Nutt. ex Torr. & Gray (PNF)**

Common name: white paint loco, silky crazyweed.

Toxin: alkaloids; produces locoism.

Habitat: open gravelly or well-drained slopes and hills at lower to middle elevations.

Animals affected: livestock.

Reference: Porter 1951, Kingsbury 1964.

***Pisum sativum* L. (AIF)**

Common name: garden pea.

Toxin: unknown.

Habitat: cultivated.

Animals affected: sheep, cattle.

Reference: Whiting et al. 1957, Kingsbury 1964.

***Poinciana gilliesii* Hook. (PIS)**

Common name: bird of paradise.

Toxin: unknown; green seed pods are gastrointestinal irritants.

Habitat: cultivated ornamental, small population established in Washington Co.

Animals affected: humans, livestock.

Reference: Cann and Verhulst 1958, Kingsbury 1964.

***Prosopis glandulosa* Torr. (PNT)**

Common name: mesquite.

Toxin: unknown; may cause a nutritional deficiency.

Habitat: dry ranges, washes and draws at low elevations, especially along streams where the water table is high.

Animals affected: cattle.

Reference: Adler 1949, Kingsbury 1964.

***Robinia pseudoacacia* L. (PIT)**

Common name: black locust.

Toxin: unknown.

Habitat: escaped from cultivation; around dwellings or along fencerows.

Animals affected: horses, cattle, sheep, poultry, humans.

Reference: Power 1901, Kingsbury 1964.

***Thermopsis montana* Nutt. (PNF)**

Common name: goldenpea, mountain thermopsis, yellow pea.

Toxin: alkaloids.

Habitat: common in pastures.

Affected animals: cattle.

Reference: Schmutz et al. 1968.

***Trifolium hybridum* L. (PIF)**

Common name: Alsike clover.

Toxin: photosensitizing compound.

Habitat: cultivated; escaped to roadsides and meadows.

Animals affected: horses, hogs, sheep, cattle.

Reference: Fincher and Fuller 1942, Kingsbury 1964.

Trifolium pratense L. (PIF)

Common name: red clover.

Toxin: unknown.

Habitat: cultivated and escaping along roadsides and ditches.

Animals affected: cattle, horses, sheep.

Reference: O'Dell 1959, Kingsbury 1964.

Trifolium repens L. (PIF)

Common name: white clover.

Toxin: cyanogenetic.

Habitat: cultivated and escaping.

Animals affected: newborn pigs.

Reference: Garner 1957, Kingsbury 1964.

Vicia villosa Roth (PIF)

Common name: hairy vetch, winter vetch.

Toxin: photosensitizing compound.

Habitat: cultivated; occasionally escaping.

Animals affected: cattle, horses.

Reference: Claughton and Claughton 1954, Kingsbury 1964.

FAGACEAE

Quercus gambelii Nutt. (PNT)

Common name: Gambel oak.

Toxin: tannins.

Habitat: throughout the state, often forming dense thickets.

Animals affected: cattle, sheep, and goats.

Reference: Boughton 1943, Kingsbury 1964.

FUMARIACEAE

Corydalis aurea Willd. (ANF)

Common name: Golden corydalis.

Toxin: alkaloids.

Habitat: woods and well-shaded mountain slopes.

Animals affected: sheep, cattle.

Reference: Sperry 1955, Kingsbury 1964.

GENTIANACEAE

Centaureum calycosum (Buckl.) Fern. (ANF)

Common name: Buckley centaury, mountain pink, arizona centaury.

Toxin: unknown.

Habitat: moist soil, river valleys.

Animals affected: sheep, goats.

Reference: Dollahite and Allen 1962, Kingsbury 1964.

HAEMODORACEAE

Iris missouriensis Nutt. (PNF)

Common name: wild iris, blue flag, fleur-de-lis, western blue flag.

Toxin: unknown.

Habitat: moist soils along stream banks, in marshes or moist mountain meadows.

Animals affected: calves, laboratory animals.

Reference: Beath et al. 1953, Kingsbury 1964.

HYPERICACEAE

Hypericum formosum H.B.K. (PNF)

Common name: southwestern St. Johnswort.

Toxin: photosensitizing compounds.

Habitat: moist soils of plains and hills.

Animals affected: cattle, sheep, horses, goats.

Reference: Harris 1951.

JUNCAGINACEAE

Triglochin concinna Davy (PNF)

Common name: arrowgrass, goosegrass, sourgrass, podgrass, Utah arrowgrass.

Toxin: hydrocyanic acid.

Habitat: salty marshes and ponds.

Animals affected: sheep, cattle.

Reference: Schmutz et al. 1968.

Triglochin debilis L. (PNF)

Common name: arrowgrass, weak arrowgrass.

Toxin: hydrocyanic acid.

Habitat: damp soils, marshes and sloughs; usually where the soil is alkaline or the water calcareous or brackish.

Animals affected: sheep, cattle.

Reference: Schmutz et al. 1968, Kingsbury 1964.

Triglochin maritima L. (PNF)

Common name: arrowgrass, seashore arrowgrass, shore arrowgrass.

Toxin: hydrocyanic acid.

Habitat: damp soils, marshes and sloughs; usually where the soil is alkaline or the water calcareous or brackish.

Animals affected: sheep, cattle.

Reference: Beath et al. 1933, Kingsbury 1964.

LAMIACEAE

Lamium amplexicaule L. (AIF)

Common name: henbit, dead nettle.

Toxin: unknown.

Habitat: occasional weed of fields and waste places.

Animals affected: sheep, horses, cattle.

Reference: Hurst 1942, Kingsbury 1964.

LILIACEAE

Allium schoenoprasum L. (PNF)

Common name: chives.

Toxin: unknown.

Habitat: cultivated; river bars, lake shores, wet meadows.

Animals affected: horses.

Reference: Kobayashi 1950, Kingsbury 1964.

Asparagus officinalis L. (PIF)

Common name: asparagus.

Toxin: unknown.

Habitat: cultivated and widely escaped.

Animals affected: cattle and dairy cows.

Reference: Los Angeles County Livestock Department 1938, Kingsbury 1964.

Ornithogalum umbellatum L. (PIF)

Common name: star-of-Bethlehem, snow-drop.

Toxin: cholchicine alkaloid.

Habitat: weed of grasslands and thickets.

Animals affected: sheep, cattle, children.

Reference: Reynard and Norton 1942, Kingsbury 1964.

Veratrum californicum Durand (PNF)

Common name: false hellebore, corn-lily, skunk cabbage.

Toxin: alkaloids.

Habitat: bogs and wet meadows from 7500 to 9500 feet.

Animals affected: cattle, sheep, fowl, humans.

Reference: Schmutz et al. 1968, Kingsbury 1964.

Yucca L. (PNS)

Note: members of this genus have been reported to contain saponins, salicylic acid, the alkaloid *imperialin*, and several resins. None of the species in which these toxins have been identified are found in Utah.

Reference: Pammel 1911.

Zigadenus elegans Pursh (PNF)

Common name: death camas, mountain death camas.

Toxin: alkaloids.

Habitat: prairies, meadows.

Animals affected: cattle, horses, hogs, fowl, humans.

Reference: Marsh et al. 1915, Kingsbury 1964.

Zigadenus paniculatus (Nutt.) Wats. (PNF)

Common name: death camas, foothill death camas, sandcorn.

Toxin: alkaloids.

Habitat: dry soils; hills and plains.

Animals affected: cattle, horses, hogs, humans.

Reference: Fleming et al. 1921, Kingsbury 1964.

Zigadenus venenosus Wats. (PNF)

Common name: death camas, meadow death camas.

Toxin: alkaloids.

Habitat: moist, grassy meadows.

Animals affected: sheep, cattle, horses, hogs, humans.

Reference: Cameron 1952, Kingsbury 1964.

PINACEAE

Pinus ponderosa Doug. ex Laws (PNT)

Common name: western yellow pine, ponderosa pine.

Toxin: unknown.

Habitat: coniferous forest at moderate elevations; dry hillsides, plateaus, slopes, valleys and mesas.

Animals affected: cattle.

Reference: MacDonald 1952, Kingsbury 1964.

POACEAE

Avena fatua L. (AIG)

Common name: wild oats.

Toxin: mechanically injurious.

Habitat: cultivated land and waste places.

Animals affected: livestock.

Reference: Pammel 1911.

Avena sativa L. (AIG)

Common name: cultivated oats.

Toxin: nitrates, photosensitizing compounds, grass tetany.

Habitat: open ground, grasslands, waste places; lawns and golf courses.

Animals affected: cattle, horses, hogs, turkeys, goats, sheep and wild ruminants.

Reference: Newsom et al. 1937, Kingsbury 1964.

***Bromus rigidus* Roth (AIG)**

Common name: riggut brome.

Toxin: mechanical injury from mature awns.

Habitat: common weed.

Animals affected: cattle and sheep.

Reference: Range Plant Handbook 1937.

***Bromus rubens* L. (AIG)**

Common name: foxtail chess, red brome.

Toxin: mechanical injury from mature awns.

Habitat: common weed, dry and saline soils.

Animals affected: cattle and sheep.

Reference: Davis 1952.

***Bromus tectorum* L. (AIG)**

Common name: cheatgrass, downy cheat.

Toxin: mechanical injury from mature awns; may also be implicated in ergot poisoning.

Habitat: common weed, especially in dry places; plains and foothills.

Animals affected: cattle.

Reference: Pammel 1911.

***Cynodon dactylon* L. Pers. (PIG)**

Common name: Bermuda grass.

Toxin: photosensitizing compound.

Habitat: open ground, grasslands, waste places; lawns and golf courses.

Animals affected: cattle.

Reference: Gibbons 1953, Kingsbury 1964.

***Eragrostis cilianensis* (All.) Link (AIG)**

Common name: lovegrass, stinkgrass, stick grass.

Toxin: unknown.

Habitat: cultivated ground, gardens and waste places; weed in fields and along roadsides.

Animals affected: horses.

Reference: Gates 1930, Kingsbury 1964.

***Festuca arundinacea* Schreb. (PIG)**

Common name: fescue, tall fescue, alta fescue, goar fescue.

Toxin: alkaloids.

Habitat: unimproved pastures; wet, heavy soils of high organic content.

Animals affected: cattle.

Reference: Maag and Tobiska 1956, Kingsbury 1964.

***Glyceria striata* Lam. Hitch. (PNG)**

Common name: fowl mannagrass.

Toxin: cyanogenetic.

Habitat: wet areas.

Animals affected: cattle.

Reference: Reynard and Norton 1942, Kingsbury 1964.

***Hilaria rigida* (Thurb.) Benth ex Scribn. (PNG)**

Common name: galleta grass, big galleta, dixie grass.

Toxin: unknown.

Habitat: dry lands and desert ranges to 4000 feet.

Animals affected: cattle.

Reference: Quortrup and McFarland 1956, Kingsbury 1964.

***Holcus lanatus* L. (PIG)**

Common name: velvet grass, mesquite grass, Yorkshire velvet grass.

Toxin: unknown.

Habitat: open ground, meadows and moist places; occasionally cultivated.

Animals affected: livestock.

Reference: Couch 1932, Kingsbury 1964.

***Hordeum jubatum* L. (PNG)**

Common name: squirreltail grass, foxtail grass, wild barley.

Toxin: mechanically injurious.

Habitat: weed in open ground, meadows, prairies, along streams, ditches and waste places.

Animals affected: sheep, cattle, horses.

Reference: Fleming and Peterson 1919, Kingsbury 1964.

***Hordeum vulgare* L. (AIG)**

Common name: cultivated barley.

Toxin: mechanically injurious.

Habitat: cultivated for grain and along road shoulders; sometimes spontaneous in waste places but not persistent.

Animals affected: hogs, dogs, humans, poultry.

Reference: Christensen and Kernkamp 1936, Kingsbury 1964.

***Setaria lutescens* (Wiegel) Hubb. (AIG)**

Common name: yellow bristle grass, foxtail grass, pigeon grass.

Toxin: mechanically injurious.

Habitat: common weed of cultivated and waste areas.

Animals affected: livestock.

Reference: Bankowski et al. 1956, Kingsbury 1964.

***Sorghum halpense* L. Pers. (PIG)**

Common name: Johnson grass.

Toxin: hydrocyanic acid, nitrates.

Habitat: weed of cultivated fields, waste places and along irrigation ditches and stream bottoms.

Animals affected: cattle, sheep, horses.

Reference: Slade 1903, Kingsbury 1964.

***Sorghum vulgare* Pers. (AIG)**

Common name: grain sorghum.

Toxin: cyanogenetic glycoside.

Habitat: cultivated.

Animals affected: cattle, sheep, horses.

Reference: Slade 1903, Kingsbury 1964.

***Stipa commata* Trin. & Rupr. (PNG)**

Common name: needle-and-thread grass.

Toxin: mechanically injurious.

Habitat: dry plains and hillsides, sandy soil.

Animals affected: livestock.

Reference: Pammel 1911.

***Stipa neomexicana* (Thurb.) Scribn. (PNG)**

Common name: New Mexican feather-grass.

Toxin: mechanically injurious.

Habitat: common in dry rocky canyons and mesas.

Animals affected: livestock.

Reference: Pammel 1911.

***Zea mays* L. (AIG)**

Common name: corn, maize.

Toxin: nitrates, under conditions of overfertilization with too little water.

Habitat: cultivated for grain, forage or silage.

Animals affected: livestock, humans.

Reference: Brady et al. 1955, Kingsbury 1964.

POLYGONACEAE

***Beta vulgaris* L. (AIF)**

Common name: beet, sugar beet, fodder beet, mangel-worzel, mangold.

Toxin: oxalates; nitrates, under conditions of overfertilization with too little water.

Habitat: cultivated.

Animals affected: livestock.

Reference: Baker and Eden 1954, Kingsbury 1964.

***Rheum rhaponticum* L. (PIF)**

Common name: rhubarb.

Toxin: oxalic acid, oxalates.

Habitat: cultivated and persisting.

Animals affected: livestock, humans.

Reference: Hansen 1930, Kingsbury 1964.

***Rumex acetosella* L. (PIF)**

Common name: sheep sorrel, dock.

Toxin: oxalates.

Habitat: common weed of acid or sterile, gravelly soils of pastures and meadows; waste places.

Animals affected: sheep.

Reference: Connor and Adams 1951, Kingsbury 1964.

***Rumex crispus* L. (PIF)**

Common name: curly dock.

Toxin: oxalates.

Habitat: moist fields and waste places.

Animals affected: sheep.

Reference: Connor and Adams 1951, Kingsbury 1964.

POLYPODIACEAE

***Dryopteris felix-mas* (L.) Schrott (PNF)**

Common name: male fern.

Toxin: thiaminase.

Habitat: mountains; damp soils, deep shaded ravines, in cliffs or tallus.

Animals affected: horses.

Reference: Harvey et al. 1944, Kingsbury 1964.

***Pteridium aquilinum* (L.) Kuhn (PNF)**

Common name: Bracken fern.

Toxin: thiaminase and its coenzymes.

Habitat: upland pastures, aspen zone.

Animals affected: livestock.

Reference: Carpenter 1950, Kingsbury 1964.

PORTULACACEAE

***Portulaca oleracea* L. (AIF)**

Common name: purslane, pusley.

Toxin: oxalates.

Habitat: common weed of garden and cultivated areas.

Animals affected: sheep.

Reference: Mathams and Sutherland 1952, Kingsbury 1964.

RANUNCULACEAE

Aconitum columbianum Nutt. (PNF)

Common name: western monkshood.

Toxin: alkaloids.

Habitat: mountains from 5000 to 10,000 feet; along streams and wet meadows; moist places and thickets.

Animals affected: livestock, humans.

Reference: Stern 1960, Kingsbury 1964.

Actaea arguta Nutt. (PNF)

Common name: baneberry, western baneberry.

Toxin: irritant oil.

Habitat: mountains in rich, moist soil.

Animals affected: livestock, humans.

Reference: Schmutz et al. 1968.

Caltha leptosepala DC. (PNF)

Common name: elkslip marshmarigold.

Toxin: glycoside (protoanemonin).

Habitat: wet mountain soils.

Animals affected: livestock.

Reference: Schmutz et al. 1968.

Delphinium andersonii Gray (PNF)

Common name: Anderson larkspur.

Toxin: alkaloids.

Habitat: subsaline soils of plains and hills.

Animals affected: cattle, sheep.

Reference: Miller 1923, Kingsbury 1964.

Delphinium barbeyi Huth. (PNF)

Common name: barbey, larkspur, tall larkspur.

Toxin: alkaloids.

Habitat: mountains; meadows and open woods, summer ranges; common under aspen and along streams.

Animals affected: cattle, occasionally sheep.

Reference: Cook 1951, Kingsbury 1964.

Delphinium nuttallianum Pritz. (PNF)

Common name: Nuttall larkspur, low larkspur, Nelson larkspur.

Toxin: alkaloids.

Habitat: moist soils, hills, foothills, and sagebrush deserts.

Animals affected: cattle, sheep.

Reference: Ewan 1945, Kingsbury 1964.

Delphinium occidentale Wats. (PNF)

Common name: duncecap larkspur, tall larkspur.

Toxin: alkaloids.

Habitat: mountain summer ranges, common under aspen and along streams; mountain meadows.

Animals affected: cattle, occasionally sheep.

Reference: Couch 1936, Kingsbury 1964.

Ranunculus acris L. (PIF)

Common name: tall field buttercup, tall buttercup.

Toxin: protoanemonin.

Habitat: common pasture weed.

Animals affected: livestock.

Reference: Tehon et al. 1946, Kingsbury 1964.

Ranunculus cymbalaria Pursh (PNF)

Common name: alkali buttercup; trailing buttercup.

Toxin: glycosides (protoanemonin).

Habitat: muddy banks along brackish streams and marshes.

Animals affected: livestock.

Reference: Fleming 1920, Kingsbury 1964.

Ranunculus flammula var. *filiformis* (Michx.) Hook. (PNF)

Common name: creeping spearwort buttercup.

Toxin: glycosides (protoanemonin).

Habitat: marshy ground of lakes, streams and ditches.

Animals affected: livestock.

Reference: Hill and van Heyningen 1951, Kingsbury 1964.

Ranunculus repens L. (PIF)

Common name: creeping buttercup.

Toxin: protoanemonin.

Habitat: meadows and marshes at lower elevations; wet pastures.

Animals affected: livestock.

Reference: Gilkey 1958, Kingsbury 1964.

Ranunculus scleratus L. (PNF)

Common name: celeryleaf crowfoot.

Toxin: glycosides (protoanemonin).

Habitat: borders of lakes, ponds and streams.

Animals affected: livestock.
Reference: Fleming 1920, Kingsbury 1964.

***Ranunculus testiculatus* Crantz (AIF)**

Common name: burbuttercup; testiculate buttercup.

Toxin: glycosides (protoanemonin).

Habitat: general in the intermountain region.

Animals affected: livestock.

Reference: Schmutz et al. 1968.

ROSACEAE

***Cercocarpus montanus* Raf. (PNS)**

Common name: mountain mahogany, birchleaf mountain mahogany, true mountain mahogany.

Toxin: cyanogenetic glycoside.

Habitat: stony hills and slopes.

Animals affected: livestock.

Reference: Burke 1960, Kingsbury 1964.

***Prunus armeniaca* L. (PIT)**

Common name: apricot.

Toxin: cyanide.

Habitat: cultivated and persisting.

Animals affected: livestock, humans.

Reference: Hurst 1942, Kingsbury 1964.

***Prunus persica* Batsch. (PNT)**

Common name: peach.

Toxin: cyanide.

Habitat: cultivated.

Animals affected: livestock.

Reference: Reynard and Norton 1942, Kingsbury 1964.

***Prunus virginiana* L. (PNT)**

Common name: choke cherry.

Toxin: cyanogenetic glycoside.

Habitat: common in hills, mountains, along streams, thickets, fencerows and edges of woods.

Animals affected: sheep, cattle.

Reference: Pijoan 1942, Kingsbury 1964.

SANTALACEAE

***Comandra umbellata* (L.) Nutt. (PNF)**

Common name: bastard toadflax.

Toxin: alkaloids, glycosides, secondary selenium accumulator.

Habitat: common weed, found in various habitats.

Animals affected: livestock.

Reference: Trelease and Beath 1949, Kingsbury 1964.

SOLANACEAE

***Datura meteloides* Dunal (ANF)**

Common name: datura, stramonium, thornapple, Jimson weed, Jamestown weed, apple of Peru, tolgaudia, sacred datura, Indian apple.

Toxin: alkaloids (atropine, hyoscyamine, hyoscyne).

Habitat: plains, dry hills and valleys; cultivated and escaping.

Animals affected: humans, horses, cattle, sheep, hogs, mules, chickens.

Reference: Hansen 1924, Kingsbury 1964.

***Datura stramonium* L. (ANF)**

Common name: Jimsonweed, sacred datura.

Toxin: alkaloids (atropine, hyoscyamine, hyoscyne).

Habitat: waste areas, rich soils of barnyards, heavily used portions of pastures.

Animals affected: horses, cattle, sheep, hogs, mules, chickens, humans.

Reference: Hansen 1924, Kingsbury 1964.

***Hyoscyamus niger* L. (BIF)**

Common name: black henbane, henbane.

Toxin: alkaloids (hyoscyamine, hyoscyne, atropine).

Habitat: widespread dry soils of roadsides and waste areas.

Animals affected: humans, fowl, livestock.

Reference: Long 1917, Kingsbury 1964.

***Lycium halmifolium* Mill. (PIS)**

Common name: matrimony vine, tea vine.

Toxin: unknown.

Habitat: cultivated and escaping around homesites and cemeteries.

Animals affected: calves, sheep.

Reference: Hansen 1927, Kingsbury 1964.

***Nicotiana attenuata* Torr. ex S. Wats. (ANF)**

Common name: wild tobacco, coyote tobacco.

Toxin: nicotine.

Habitat: dry, sandy stream beds and flats.

Animals affected: horses, pigs, livestock, humans.

Reference: Marsh et al. 1927, Kingsbury 1964.

Nicotiana trigonophylla Dunal ex DC.
(ANF)

Common name: wild tobacco, desert tobacco.

Toxin: nicotine.

Habitat: dry desert soils.

Animals affected: horses, pigs, livestock, humans.

Reference: Marsh et al. 1927, Kingsbury 1964.

Solanum dulcamara L. (PIF)

Common name: European bitter-sweet, climbing nightshade, bitter nightshade.

Toxin: glycoalkaloids.

Habitat: woods, thickets and waste places; cultivated and escaping.

Animals affected: cattle, horses, sheep, humans.

Reference: Craig and Kehoe 1925, Kingsbury 1964.

Solanum eleagnifolium Cav. (PNF)

Common name: silverleaf nightshade, white horenettle, trapillo.

Toxin: glycoalkaloids.

Habitat: serious weed of prairies, open woods and disturbed soils; dry ground; barnyards.

Animals affected: cattle, sheep.

Reference: Buck et al. 1960, Kingsbury 1964.

Solanum nigrum L. (AIF)

Common name: black nightshade.

Toxin: glycoalkaloids.

Habitat: common weed of fields and waste places.

Animals affected: livestock, humans.

Reference: Carey 1955, Kingsbury 1964.

Solanum rostratum Dunal (ANF)

Common name: buffalo bur, Kansas thistle, Texas thistle, buffalobur nightshade.

Toxin: glycoalkaloids.

Habitat: plains, roadsides, barnyards.

Animals affected: hogs.

Reference: Simic 1943, Kingsbury 1964.

Solanum triflorum Nutt. (ANF)

Common name: three flowered nightshade, cutleaf nightshade.

Toxin: glycosides.

Habitat: prairies, fields and waste places; weed of cultivation and disturbed soils.

Animals affected: horses, cattle.

Reference: Pammel 1921, Kingsbury 1964.

TYPHACEAE

Typha latifolia L. (PNF)

Common name: cattail.

Toxin: unknown.

Habitat: common in moist soils, marshes and ponds.

Animals affected: horses.

Reference: Hansen 1930, Kingsbury 1964.

ZYGOPHYLLACEAE

Tribulus terrestris L. (AIF)

Common name: puncture vine, caltrap.

Toxin: nitrates, photosensitizing compound.

Habitat: dry soils of waste lands, roadsides and deserts.

Animals affected: sheep.

Reference: Durrell et al. 1952, Kingsbury 1964.

LITERATURE CITED

- AANES, W. A. 1961. Pingue (*Hymenoxys richardsonii*) Poisoning in sheep. *Am. J. Vet. Res.* 22:47.
- ADLER, H. E. 1949. Indigestion from an unbalanced kiawe (mesquite) bean diet. *J. Am. Vet. Med. Assoc.* 115:263.
- ALBERTS, H. W. 1931. Poisoning of livestock by plants. *Alaska Agr. Expt. Sta., Rept.*, 1930:35.
- ANIMAL DISEASE AND PARASITE RESEARCH DIVISION. 1958. Sixteen plants poisonous to livestock in the western states. *USDA Farmers' Bull.* 2106.
- BAKER, C. J. L., AND A. EDEN. 1954. Studies on the oxalate content of the leaves of certain varieties of *Beta vulgaris*. *J. Agric. Sci.* 44:394.
- BAMFORD, F. 1951. Poisons, their isolation and identification. Blakiston Company, Philadelphia. 3d ed.
- BANKOWSKI, R. A., R. W. WICHMANN, AND E. E. STUART. 1956. Stomatitis of cattle and horses due to yellow bristle grass (*Setaria lutescens*). *J. Am. Vet. Med. Assoc.* 129:149.
- BEATH, O. A., J. H. DRAIZE, AND H. F. EPPSON. 1933. Arrow grass, chemical and physiological considerations. *Wyoming Agri. Expt. St. Bull.* 193.
- BEATH, O. A., C. S. GILBERT, H. F. EPPSON, AND I. ROSENFELD. 1953. Poisonous plants and livestock poisoning. *Wyoming Agr. Expt. Sta. Bull.* 324.
- BINNS, W., AND L. F. JAMES. 1961. A congenital deformity in calves, similar to "crooked calf disease," has been experimentally produced by feeding heifers lupine and lead. *Proc. Am. Soc. Anim. Prod. (Western Sect.)* 12(66):1.
- BOUGHTON, I. B. 1943. Oak brush poisoning. *Texas Vet. Bull.* 5(4):2.

- BRADY, D. E., J. E. COMFORT, J. F. LASLEY, AND W. H. PFANDER. 1955. Forage poisoning in Missouri due to excessive amounts of nitrate. Missouri Agr. Expt. Sta., Bull. 652:19.
- BRAKENRIDGE, D. T. 1956. Nitrate poisoning caused by turnips and redroot. New Zealand Vet. J. 4:165.
- BUCK, W. B., J. W. DOLLAHITE, AND T. J. ALLEN. 1960. Silver-leaved nightshade poisoning. J. Am. Vet. Med. Assoc. 137:348.
- BUCK, W. B., L. F. JAMES, AND W. BINNS. 1961. Changes in serum transaminase activities associated with plant and mineral toxicity in sheep and cattle. Proc. Am. Col. Vet. Toxicol. 1961:13.
- BURKE, J. M., J. MARCHISOTTO, J. J. A. McLAUGHLIN, AND L. PROVASOLI. 1960. Analysis of the toxin produced by *Gonyaulax catenella* in axenic pure culture. Ann. N.Y. Acad. Sci. 90:837.
- CAMERON, K. 1952. Death camas poisoning. Northwest Med. 1952:682.
- CANN, H. M., AND H. L. VERHULST. 1958. Poisonous plants. Natl. Clearinghouse Pois. Contr. Cent., September 1958:2.
- CAREY, J. C. 1955. Black nightshade poisoning in swine. N. Am. Vet. 36:466.
- CARPENTER, K. J., A. T. PHILLIPSON, AND W. THOMSON. 1950. Experiments with dried bracken (*Pteris aquilina*). British Vet. J. 106:292.
- CASE, A. A. 1957. Some aspects of nitrate intoxication in livestock. J. Am. Vet. Med. Assoc. 130:323.
- CHRISTENSEN, J. J., AND H. C. H. KERNKAMP. 1936. Studies on the toxicity of blighted barley to swine. Minnesota Agr. Expt. Sta., Tech. Bull. 113.
- CLAWSON, A. B. 1933. Additional information concerning larkspur poisoning. Supplement to USDA, Farmers' Bull. 988.
- CLAWSON, A. B. 1933. The American groundsels, species of *Senecio* as stock-poisoning plants. Vet. Med. 28:105.
- CLAUGHTON, W. P., AND H. D. CLAUGHTON. 1954. Vetch seed poisoning. Auburn Vet. 10:125.
- CONNOR, H. E., AND N. M. ADAMS. 1951. Poisonous plants in New Zealand. Dept. Sci. and Ind. Res. Bull. 99.
- COOK, C. W., AND L. A. STODDART. 1953. The halogeton problem in Utah. Utah Agr. Expt. Sta. Bull. 364.
- COOK, W. B. 1951. The isolation and study of the alkaloids of *Delphinium barbeyi* Huth. University of Wyoming Publ. 17:105.
- COUCH, J. F. 1922. The toxic constituent of greasewood (*Sarcobatus vermiculatus*). Am. J. Pharm. 94:631.
- COUCH, J. F. 1929. A contribution to the study of locoism. J. Pharm. and Exptl. Therapeut. 36:55.
- COUCH, J. F. 1932. Poisoning of livestock by plants that produce hydrocyanic acid. USDA Leaflet 88.
- COUCH, J. F. 1936. Deltaline, a new alkaloid from *Delphinium occidentale* S. Wats. J. Am. Chem. Soc. 58:684.
- CRAIG, J. F., AND D. KEHOE. 1925. Plant poisoning. Vet. Rec. 38:795.
- DAVIS, C. L. 1958. *Senecio* poisoning in livestock. Western Vet. 5:28.
- DAVIS, R. J. 1952. Flora of Idaho. Brigham Young University Press. Provo, Utah. 836 pp.
- DAYTON, W. A. 1948. Poisonous plants. Yearbook of agriculture, pp. 729-734.
- DEEM, A. W., F. THORP, AND L. W. DURRELL. 1939. Range plant newly found to be poisonous. Science 89:435.
- DOLLAHITE, J. W., AND T. J. ALLEN. 1962. Poisoning of cattle, sheep and goats with *Lobelia* and *Centaureium* species. Southw. Vet. 15:126.
- DOLLAHITE, J. T., T. SHAYER, AND B. J. CAMP. 1962. Injected saponins as abortifacients. Am. J. Vet. Res. 23:1261.
- DOLLAHITE, J. W., AND W. V. ANTHONY. 1957. Poisoning of cattle with *Gutierrezia microcephala*, a perennial broomweed. J. Am. Vet. Med. Assoc. 130:525.
- DURRELL, L. W., R. JENSEN, AND B. KLINGER. 1952. Poisonous and injurious plants in Colorado. Colorado Agr. Expt. Sta. Bull. 412-A.
- EATON, G. 1941. A series of cases of poisoning in cattle. Vet. Rec. 53:145.
- EVERS, R. A. AND R. P. LINK. 1972. Poisonous plants of the Midwest and their effects on livestock. University of Illinois (Urbana) Spec. Pub. 24. 165 pp.
- EWAN, J. 1945. A synopsis of the North American species of *Delphinium*. University of Colorado Studies (Ser. D) 2:55.
- FINCHER, M. G., AND H. K. FULLER. 1942. Case report, photosensitization—trifoliosis—light sensitization. Cornell Vet. 32:95.
- FINNEMORE, H. 1909. The constituents of Canadian hemp. Part II. Cynotoxin. Proc. Chem. Soc. (London) 25:77.
- FLEMING, C. E. 1920. Poisonous range plants. Nevada Agr. Expt. Sta., Ann. Rept. 1919:39.
- FLEMING, C. E., M. R. MILLER, AND L. R. VAWTER. 1922. The spring rabbit-brush (*Tetradymia glabrata*), a range plant poisonous to sheep. Nevada Agr. Expt. Sta. Bull. 104.
- FLEMING, C. E., AND N. F. PETERSON. 1919. Don't feed foxtail hay to lambing ewes. Nevada Agr. Expt. Sta. Bull. 97.
- FLEMING, C. E., N. F. PETERSON, M. R. MILLER, L. R. VAWTER, AND L. H. WRIGHT. 1920. The narrow-leaved milkweed (*Asclepias mexicana*) and the broad-leaved or snowy milkweed (*Asclepias speciosa*)—plants poisonous to livestock in Nevada. Nev. Agr. Expt. Sta. Bull. 99.
- FLEMING, C. E., N. F. PETERSON, M. R. MILLER, AND L. H. WRIGHT. 1921. Death camas (*Zygadenus paniculatus* and *Zygadenus venenosus*): plants poisonous to sheep and cattle. Nevada Agr. Expt. Sta. Bull. 101.
- FYLES, F. 1920. Principal poisonous plants of Canada. Canada Dept. Agr., Exptl. Farms Bull. 39 (2d ser.).
- GARNER, R. J. 1957. Veterinary toxicology. Bailliere, Tindall, and Cox, London (Williams and Wilkins Co., Baltimore).
- GATES, F. C. 1930. Principal poisonous plants in Kansas. Kansas Agr. Expt. Sta. Tech. Bull. 25.
- GIBBONS, W. J. 1953. "Downer" or "Bermuda grass poisoning." N. Am. Vet. 34:433.
- GILKEY, H. M. 1958. Livestock-poisoning plants. Oregon Agr. Expt. Sta. Bull. 564.

- GLOVER, G. H. 1917. The whorled milkweed. *Am. J. Vet. Med.* 12:303.
- GRESS, E. M. 1935. Poisonous plants of Pennsylvania. *Penn. Dept. Agr. Bull.* 18(5) (Gen. Bull. 531).
- GUSSOW, H. T. 1912. Horsetail, *Equisetum arvense* L. Canada Dept. Agr., Dom. Exptl. Farms, Rept. 1912:210.
- HANSEN, A. A. 1924. Jimson poisoning. *Better Crops* 2(6):28.
- HANSEN, A. A. 1927. Stock poisoning by plants in the nightshade family. *J. Am. Vet. Med. Assoc.* 71:221.
- HANSEN, A. A. 1930. Indiana plants injurious to livestock. *Purdue (Indiana) Agr. Expt. Sta. Circ.* 175.
- HARRINGTON, H. D. 1964. *Manual of the plants of Colorado.* Swallow Press, Inc. Chicago, Illinois. 666 pp.
- HARRIS, G. A. 1951. St. Johnswort on western ranges. USDA, Northern Rocky Mtn. For. and Range Expt. Sta. Paper 26. 18 pp.
- HARVEY, R. B., A. H. LARSON, R. H. LANDON, W. L. BOYD, AND L. C. ERICKSON. 1944. Weeds poisonous to livestock. *Minnesota Agr. Expt. Sta. Bull.* 388.
- HERSHEY, A. L. 1945. Some poisonous plants problems of New Mexico. *New Mexico Agr. Expt. Sta. Bull.* 322.
- HILL, R., AND R. VAN HEYNINGEN. 1951. Ranunculin: the precursor of the vesicant substance of the buttercup. *Biochem. J.* 49:332.
- HOLMGREN, A. H. 1945. Two poisonous milkweeds. *Utah Agr. Expt. Sta., Farm and Home Sci.* 6(2):11.
- HUFFMAN, W. T., E. A. MORAN, AND W. BINNS. 1956. Poisonous plants. USDA, *Yearbook of Agr.* 1956:118.
- HURST, E. 1942. The poison plants of New South Wales. N.S.W. Poison Plants Committee, Sydney.
- JAMES, L. F., M. C. WILLIAMS, AND A. T. BLEUH. 1976. Toxicity of *Bassia hyssopifolia* to sheep. *J. Range Manage.* 29(4):284-285.
- JOHNSTON, A., AND R. W. PEAKE. 1960. Effect of selective grazing by sheep on the control of leafy spurge (*Euphorbia esula* L.). *J. Range Manage.* 12:192.
- KEELER, R. F. 1978. Reducing incidence of plant-caused congenital deformities in livestock by grazing management. *J. Range Manage.* 31(5):355-360.
- KINGSBURY, J. M. 1961. Knowledge of poisonous plants in the United States—brief history and conclusions. *Econ. Bot.* 15(2):119-130.
- KINGSBURY, J. M. 1964. *Poisonous plants of the United States and Canada.* Prentice-Hall Inc., New Jersey. 626 pp.
- KOBAYASHI, T. 1950. Studies on the histo-pathologic changes of experimental cases of the "ezonegi-poisoning" in horses. *Japanese J. Vet. Sci.* 12:209.
- KRUEGER, W. C. AND L. A. SHARP. 1978. Management approaches to reduce livestock losses from poisonous plants in rangeland. *J. Range Manage.* 31(5):347-350.
- LAYCOCK, W. A. 1978. Coevolution of poisonous plants and large herbivores in rangelands. *J. Range Manage.* 31(5):335-342.
- LEVIN, D. A. 1976. Alkaloid-bearing plants: an ecogeographic perspective. *Amer. Natur.* 110: 261-284.
- LEWIS, H. B., R. S. FAJANS, M. B. ESTERER, C. SCHEN, AND M. OLIPHAT. 1948. The nutritive value of some legumes: lathyrism in the rat. *J. Nutr.* 36:537.
- LEWIS, H. B., AND A. R. SCHULERT. 1949. Experimental lathyrism in the white rat and mouse. *Proc. Soc. Exptl. Biol. and Med.* 71:440.
- LONG, H. C. 1917. *Plants poisonous to livestock.* Cambridge (England) University Press.
- LOS ANGELES COUNTY LIVESTOCK DEPARTMENT. 1938. *Poisonous and injurious plants of Los Angeles County.* County of Los Angeles, California.
- MAAG, D. D., AND J. W. TOBISKA. 1956. Fescue lameness in cattle. II. Ergot alkaloids in tall fescue grass. *Am. J. Vet. Res.* 17:202.
- MACDONALD, M. A. 1952. Pine needle abortion in range beef cattle. *J. Range Manage.* 5:150.
- MARSH, C. D., A. B. CLAWSON, J. F. COUCH, AND H. MARSH. 1921. Western sneezeweed (*Helenium hoopesii*) as a poisonous plant. USDA, Dept. Bull. 947.
- MARSH, C. D., A. B. CLAWSON, AND W. W. EGGLESTON. 1936. The locoweed disease. USDA, *Farmers' Bull.* 1054, rev.
- MARSH, C. D., A. B. CLAWSON, AND H. MARSH. 1915. *Zygadenus*, or death camas. USDA, Dept. Bull. 125.
- MARSH, C. D., A. B. CLAWSON, AND H. MARSH. 1916. Lupines as poisonous plants. USDA, Dept. Bull. 405.
- MARSH, C. D., A. B. CLAWSON, AND G. C. ROE. 1927. Wild tobaccos (*Nicotiana trigonophylla* Dunal and *Nicotiana attenuata* Torrey) as stock-poisoning plants. USDA, *Tech. Bull.* 22.
- MATHAMS, R. H., AND A. K. SUTHERLAND. 1952. The oxalate content of some Queensland pasture plants. *Queensland J. Agr. Sci.* 9:317.
- MATHEWS, F. P. 1933. The toxicity of *Baileya multiradiata* for sheep and goats. *J. Am. Vet. Med. Assoc.* 83:673.
- MCCULLOCH, E. C. 1940. The experimental production of hepatic cirrhosis by the seed of *Amsinckia intermedia*. *Science* 91:95.
- McNAIR, J. B. 1923. *Rhus dermatitis*, its pathology and chemotherapy. University of Chicago Press.
- MECKE, M. B. 1979. Poisonous range plants of Wyoming—their importance and management. Annual Meeting of Society for Range Management, Casper, Wyoming. 14 pp. Unpublished manuscript.
- MERRILL, L. B. AND J. L. SCHUSTER. 1978. Grazing management practices effect on livestock loss from poisonous plants. *J. Range Manage.* 31(5): 351-354.
- METTLER, F. A., AND G. M. STERN. 1963. Observations on the toxic effects of yellow star thistle. *J. Neuropath. Expt. Neurol.* 22:164.
- MIHALOPOULOS, N. G. 1972. *Common poisonous plants of Utah and the Intermountain West.* Educational Media, Inc. Salt Lake City. 41 pp.
- MILLER, M. R. 1923. Alkaloidal assays of *Delphinium andersonii* Gray. *J. Am. Pharm. Assoc.* 12:492.

- MOORE, C. W. 1909. The constituents of the rhizome of *Apocynum androsaemifolium*. J. Chem. Soc. (London), Trans. 95:734.
- MUENSCHER, W. C. 1930. Leafy spurge and related weeds. New York State Col. Agr., Cornell Extension Bull. 192.
- NEWSOM, I. E., E. N. STOUT, F. THORP, C. W. BARBER, AND A. H. GROTH. 1937. Oat hay poisoning. J. Am. Vet. Med. Assoc. 90:66.
- NIELSEN, D. B. 1978. The economic impact of poisonous plants on the range livestock industry in the seventeen western states. J. Range Manage. 31(5):325-328.
- O'DELL, B. L. 1959. A study of the toxic principle in red clover. Missouri Agr. Expt. Sta., Res. Bull. 702.
- PAMMELL, L. H. 1911. A manual of poisonous plants. Torch Press, Cedar Rapids, Iowa.
- PAMMELL, L. H. 1921. Three-flowered nightshade poisonous. Vet. Med. 16(2):46.
- PENNY, R. H. C. 1953. Hemlock poisoning in cattle. Vet. Rec. 65:669.
- PIJON, M. 1942. Cyanide poisoning from choke cherry seed. Am. J. Med. Sci. 204 (n.s.):550.
- PORTER, C. L. 1951. *Astragalus* and *Oxytropis* in Colorado. University of Wyoming Publ. 16:1.
- POWER, F. B. 1901. The chemistry of the bark of *Robinia pseudo-acacia*, Linne. Pharmaceut. J.
- QUORTRUP, E. R., AND R. J. McFARLAND. 1956. Animal losses involving noxious weeds in San Diego County. California Vet. 9(5):14.
- RANGE PLANT HANDBOOK. 1937. Prepared by Forest Service, USDA.
- REYNARD, G. B., AND J. B. S. NORTON. Poisonous plants of Maryland in relation to livestock. Maryland Agr. Expt. Sta. Tech. Bull. A10.
- RODERICK, L. M., AND A. F. CHALK. 1931. Studies on sweet clover disease. North Dakota Agr. Expt. Sta. Bull. 250.
- SAMPSON, A. W., AND H. E. MALMSTEN. 1942. Stock-poisoning plants of California. California Agr. Expt. Sta. Bull. 593.
- SCHMUTZ, E. M., B. N. FREEMAN, AND R. E. REED. 1968. Livestock-poisoning plants in Arizona. University of Arizona Press, Tucson. 176 pp.
- SHRIFT, A. 1958. Biological activities of selenium compounds. Bot. Rev. 24:550.
- SIMIC, W. J. 1943. Solanine poisoning in swine. Vet. Med. 38:353.
- SLADE, H. B. 1903. Prussic acid in sorghum. J. Am. Chem. Soc. 25:55.
- SMALL, E. AND A. CRONQUIST. 1976. A practical and natural taxonomy for *Cannabis*. Taxon 5:405-435.
- SPERRY, O. E., J. W. DOLLAHITE, J. MORROW, AND G. O. HOFFMAN. 1955. Texas range plants poisonous to livestock. Texas Agr. Expt. Sta. Bull. 796.
- STERN, E. S. 1960. The diterpenoid alkaloids from *Aconitum*, *Delphinium*, and *Garrya* species. In Manske, R. H. F., ed., The alkaloids. Academic Press, New York. Vol. VII.
- STEYN, D. G. 1934. The toxicology of plants in South Africa. Central News Agency, Ltd., Johannesburg.
- STODDART, L. A., A. H. HOLMGREN AND C. W. COOK. 1949. Important poisonous plants of Utah. Spec. Report No. 2, Agr. Expt. Sta., Utah State Agr. Col., Logan, Utah. 21 pp.
- TEHON, L. R., C. C. MORRIL, AND R. GRAHAM. 1946. Illinois plants poisonous to livestock. Illinois Ext. Serv. Circ. 599.
- THOMSON, R. B., AND H. B. SIFTON. 1922. A guide to the poisonous plants and weed seeds of Canada and the northern United States. University of Toronto Press, Toronto.
- THROP, F., JR., G. S. HARSHFIELD, L. W. DURRELL, AND C. G. BARR. 1940. *Oxytenia acerosa*—A plant poisonous to livestock. J. Am. Vet. Med. Assoc. 96:97.
- TRELEAVE, S. F., AND O. A. BEATH. 1949. Selenium. New York.
- USDA. 1965. Twenty-two plants poisonous to livestock in the western states. USDA, Agr. Information Bull. No. 327. 64 pp.
- VALENTINE, J. F. 1978. US-Canadian range management, 1935-1977: a selected bibliography on ranges, pastures, wildlife, livestock and ranching. Oryx Press, Phoenix, Arizona. 337 pp.
- VOLKER, R. 1950. Eugen Fröhner's Lehrbuch der Toxikologie. Ferdinand Enke Verlag, Stuttgart. 6th ed.
- WALTER, E. D., G. R. VAN ATTA, C. R. THOMPSON, AND W. D. MACLAY. 1954. Alfalfa saponin. J. Am. Chem. Soc. 76:2271.
- WELSH, S. L. 1975. Utah flora: *Fabaceae*—Leguminosae. Great Basin Nat. 35(3):225-367.
- . 1980. Utah flora: miscellaneous families. Great Basin Nat. 40:35-58.
- WELSH, S. L. AND G. MOORE. 1973. Utah plants—Tracheophyta. Brigham Young University Press, Provo, Utah. 474 pp.
- WEST, E. 1957. Poisonous plants around the home. Florida Agr. Expt. Sta. Circ. 5-100.
- WHITING, F., R. CONNELL, P. J. G. PLUMMER, AND R. D. CLARK. 1957. Incoordination (*Cerebellar Ataxia*) among lambs from ewes fed peavine silage. Canad. J. Comp. Med. and Vet. Sci. 21:77.
- WILLIAMS, M. C. AND F. A. NORRIS. 1969. Distribution of miserotoxin in varieties of *Astragalus miser*. Dougl. ex Hook. Weed Science 17:236-238.
- WILLIAMS, M. C. AND R. C. BARNEY. 1977. The occurrence of nitro-toxins in North American *Astragalus* (Fabaceae). Brittonia 29:310-326.